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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/919,699	07/31/2001	Donald J. Milligan	10006051-1	5384

7590 01/16/2004

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EXAMINER

NGUYEN, LAM S

ART UNIT	PAPER NUMBER
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2853

DATE MAILED: 01/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/919,699

Applicant(s)

MILLIGAN ET AL.

Examiner

LAM S NGUYEN

Art Unit

2853

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-49 is/are pending in the application.
- 4a) Of the above claim(s) 1-14 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 30 and 44-49 is/are allowed.
- 6) ☒ Claim(s) 15-29, 31 and 34 is/are rejected.
- 7) ☒ Claim(s) 32-33, 35-43 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

Art Unit: 2853

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 15-20, 28-29, 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murthy et al. (US 5658471) in view of Mantell et al. (US 5867192).

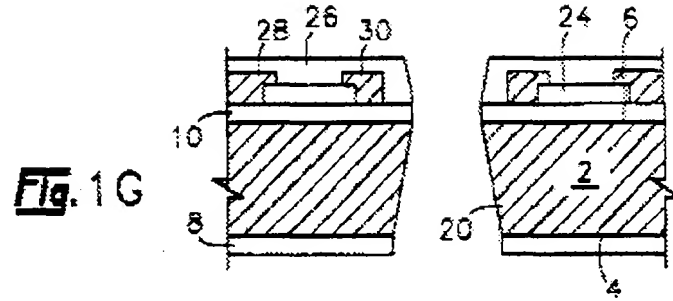
Murthy et al. disclose a fluid ejecting device comprising:

a silicon substrate having <100> crystalline orientation (FIG. 1G, element 2, and column 1, line 44-45),

a plurality of fluid/ink drop generators (FIG. 1G) formed on a first surface of said silicon substrate,

a fluid/ink feed slot extending from a second surface of said silicon substrate to said first surface (FIG. 1G, element 20) having an opening at the first surface having a width W1 (FIG. 4B, element 48) that is less than a width W2 (FIG. 4B, element 46) of an opening at the second surface.

Referring to claims 16, 19, 31: wherein W1 is about 100 micrometers or less (column 8, line 45-50).



Referring to claims 17, 20, 31: wherein W2 is about 300 micrometers or less (column 8, line 45-50).

Murthy et al. do not disclose that said fluid slot formed by deep reactive ion etching followed by anisotropic wet etching.

However, Mantel et al. disclose a process of making cavities in a silicon substrate having <100> crystalline orientation wherein the cavities are formed by deep reactive ion etching process followed by anisotropic wet etching process (column 3, line 43 to column 4, line 23).

Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to form the ink feed slots in the printhead disclosed by Murthy et al. by the process of the deep reactive ion etching followed by anisotropic wet etching as disclosed Mantell et al. The motivation of doing so is that the advantage of the reactive ion etching is easily reproducible and the wet etching process is self-terminating, this is convenient for mass production as taught by Mantell et al. (column 3, line 46-48 and column 4, line 5-10).

2. Claims 21-27, 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murthy et al. (US 5658471) in view of Mantell et al. (US 5867192) and further in view of Yagi et al. (US 6143190).

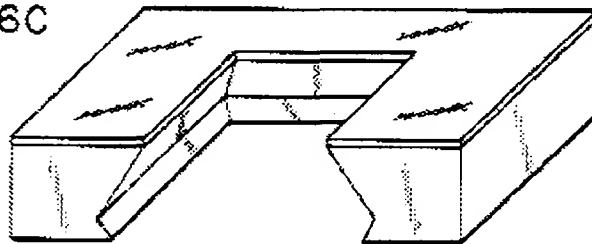
Murthy et al. and Mantell et al. disclose the claimed invention as discussed above, except wherein the fluid feed slot has a diamond shape (**Referring to claims 21, 24**), the fluid feed slot

Art Unit: 2853

has a width at a location intermediate the first surface and the second surface which is larger than width W1 (**referring to claims 22, 25, 27**), wherein a longitudinal extent of the fluid feed slot is aligned with a $\langle 100 \rangle$ plane of the substrate (**Referring to claims 23 and 26**), and wherein the substrate has a thickness of about 675 micrometers or less (**Referring to claim 34**).

Yagi et al. disclose a method of producing a through-hole, silicon substrate having a thickness of 525 micrometers (column 10, line 55-58) and to form a fluid feed shot (in term of “a through-hole serving as an ink supplying hole” (column 27, line 4-6) in a $\langle 100 \rangle$ silicon wafer (column 12, line 33-34) in a diamond shape (FIG. 6C) with a width at a location intermediate the first surface and the second surface which is larger than width W1 (FIG. 6C), and wherein a longitudinal extent of the fluid feed slot is aligned with a $\langle 100 \rangle$ plane of the substrate (FIG. 6C).

FIG. 6C



Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to shape the ink feed slots in the printhead disclosed by Murthy et al. in view of Mantell et al. as a diamond having a width at a location intermediate the first surface and the second surface larger than width W1 as disclosed by Yagi et al. The motivation of doing so is to gain the controlling of the fluid conductance to a desired value, which could not be achieved by the conventional technique, as taught by Yagi et al. (column 12, line 20-28).

Allowable Subject Matter

3. Claims 30, 44-49 are allowed and Claims 32, 33, 35-43 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Referring to claims 30, 32, 35: The most pertinent art fails to disclose wherein said fluid slot formed by deep reactive ion etching to a depth of at least one-half a thickness of the silicon substrate followed by anisotropic wet etching. Therefore, the claimed invention is not disclosed by the cited prior art.

Referring to claims 33, 36: The most pertinent art fails to disclose wherein said fluid slot formed by deep reactive ion etching to a depth of at least about 475 micrometers. Therefore, the claimed invention is not disclosed by the cited prior art.

Referring to claims 38 and 44: The most pertinent art fails to disclose wherein:

$$W1 \approx W2 + 2(DD \cdot \tan \alpha + (DD - STH / \tan(54.7 \text{deg})))$$

Wherein: STH is the thickness of the substrate

DD is a depth caused by the deep reactive ion etching process

α is an angle of re-entrancy

W1 and W2 are the openings at the first and second surfaces.

Therefore, the claimed invention is not disclosed by the cited prior art.

Claims 37, 39-43 and 45-49 are also allowed because they depend directly/indirectly on claim 35, 38 or 44.

Response to Arguments

Art Unit: 2853

Applicant's arguments filed 12/08/2003 have been fully considered but they are not persuasive.

Regarding to the argument on page 10: In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Mantel et al. disclose a technique of making cavities in a silicon substrate having <100> crystalline orientation wherein the cavities are formed by deep reactive ion etching process followed by anisotropic wet etching process (column 3, line 43 to column 4, line 23). The advantage of this technique is that the reactive ion etching is easily reproducible and the wet etching process is self-terminating (column 3, line 46-48 and column 4, line 5-10). Therefore, the motivation for combining Mantell et al. and Murthy et al. is found that it is the generally available knowledge to one having ordinary skill in the art to use the above technique disclosed by Mantell et al. for creating cavities in a silicon substrate such as ink/fluid feed slots in the printhead disclosed by Murthy et al. to obtain the above advantage. In addition, Mantell et al. teach that using "this process to form a relatively small opening in the main surface of the silicon and the cavities gradually increase in size slightly beneath the main surface, and then decrease to form sharp corner" (column 2, line 1-5). Therefore, the cavity is formed by this process having a shape that is the same as the one of the feed slots claimed by the applicants.

Conclusion

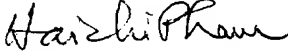
Any inquiry concerning this communication or earlier communications from the examiner should be directed to LAM S NGUYEN whose telephone number is (703)305-3342. The examiner can normally be reached on 7:00AM - 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, STEPHEN D. MEIER can be reached on (703)308-4896. The fax phone numbers for the organization where this application or proceeding is assigned are (703)8872-9306 for regular communications and (703)305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

LN

January 11, 2004


HAI PHAM
PRIMARY EXAMINER